

# PROGRAMMED INSTRUCTION IN MATHEMATICS

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#### Introduction

Programmed instruction is a teaching technique which developed as a result of the application of the scientific method to the teaching learning process. It is a method which uses highly structural materials which take the place of a teacher for the learner. The materials are designed carefully and are thoroughly evaluated for effectiveness.

### Characteristics of P. I.

P. I. owes its effectiveness to the following characteristics, which are not generally present in other forms of instruction. They are:

### 1. Small steps:

The material to be learned is presented in small steps or increments (called frames). The steps are presented in a logical sequence so that each step builds on the preceding steps and it selves serves as a base for succeeding ones.

### 2. Active student participation:

The student is continually made to interact with the program. With each small step, the student is required to make a response.

## 3. Immediate knowledge of results:

As soon as a student responds, he is shown the correct response to compare with his own. This provides him the necessary feedback.

# 4. Self-Pacing:

Each student works at his own pace through the program. In some programs, the amount of instruction he receive is decided by his responses.

# 5. Accountable:

It is supposed to accomplish something, and this is measurable in terms of change in student behavior.

# Historical Background:

P.I has ties with the nineteenth century work of, among others, Pavlov and Thorndike. Pavlov studied conditioned (that is learned) reflexes in dogs, while Thorndike propounded his "law of Effect". This law says that the connection between a stimulus and response is strengthened only if some reward follows the response.

The modern developments in P.I may be said to originate from the work of S.L. Pressey of Ohio State University in early 1920's. In 1926 he developed a testing machine, which formed the bases for development of teaching machines. This work was virtually forgotten until Prof. B.F. Skinner of Harvard University came up with his theory of "operant condition", in 1950's Linear Programming style developed by Skinner emphasizes the gradual conditioning of responses through practice and repetition. Another important name in the field of programming belonging to the same period is Norman Crowder who initiated what are called branching programs. During the last decade the field of P.I has made rapid strides of great and continuing promise. The promise of P.I is in the tradition of instructional improvement.

# 4. Empirical Approach:

A Programme can be defined as "a course material which is designed for specific students dealing with a specific topic and which has been evaluated as effective for give objectives.

Educators have been using course materials to assist instruction-text books, assignment sheets, handouts etc. All course materials are, to some extent, evaluated by users. All course materials are, to some extent, evaluated by users. A Program is singled out as a special case of course material, because of the thorough evaluation done with regard to its effectiveness. The main strength the programs is the empirical approach to its design. The materials are repeatedly tried out and found reliable with regard to controlling the learning process to achieve the

instructional objectives.

# This approach depends on 6 primary elements.

- 1. The Instructional Objectives
- 2. The target population and entry behavior characteristics
- 3. Criterion test for quantitative evaluation
- 4. Design of program keeping (1) and (2) in view
- 5. Evaluating the material
- 6. Redesigning the material based on all evidences available from trails.

The important thing is the continuing process of restructuring the materials on the evidences arising from use. Note that objectives are held constant, test instruments are held constant, only the learning strategies used are changed on the basis of evidence arising from use to affect optional learning.

# 5. Programming Models

There are two principal models – Skinners (Linear) and Crowders (Branching)

#### 5.1. Linear Form:

In this form all the students read and respond to the same frames. The program is linear because there is a single line or path for all students follow.

An interesting variation is the linear program with criterion frames. These frames test entering behavior at various points in the programs to determine whether the student should go through the sequence of frames which follows. The following is the diagram of a linear program with criterion fame and a subsequence.

The linear programs are response centered. In each frame only enough material is presented to evoke the correct responses and to permit the reinforcement of each response.

# 5.2. Branching Form:

In this Program the student proceeds to the next frame until he makes an error. The errors branch supplementary materials design to give him remedial instruction. Here the amount of information in the frames is fairly large. The response from the learners involves multiple choices each alternative is associated with a page No which directs the student to a frame which confirms his response and introduces a segment of new material an incorrect answer returns him to the initial frame to start over. A branching program in a book form is called a scrambled. Branching programs tend to emphasize the presentation of material rather than the students detailed responses to this material and are therefore generally stimulus centered.

In earlier days, programmers tend to adopt one or other model and were inflexible in their methods. But research has not supported the climes of superiority of either a method. It is now realized that the method used should be adopt to learning tasks and very their methods to suit the requirements of the instructional situations

# 6. Advantages of P.I

The advantages are

- 1. It is a self study technique
- 2. The transfer of knowledge is regulated at the peace of the learner
- 3. This technique can be used as additional teaching device slow learners.
- 4. Demands achieve student participation
- 5. Immediate feedback reinforce learning
- 6. Ensure uniform competence among the learners
- 7. Instructors competence, language, quality of instructions etc. do not affect learning and every learner get uniform instruction from a program validated on a similar group
- 8. The teacher is relieved from routine and labors work repeating his lessons over and over. He can use his contact time for discussion and guidance etc.

We have to note that P. I.

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- 1. Is not an audio visual aid.
- 2. Is teaching technique and not a testing method.
- 3. Is not a panacea for all ills of education?
- 4. Does not replace the teacher but redefines his role from being a static knowledge dispenser to that of an imaginative and dynamic professional.

### 7. The Potential use of P. I. in mathematical education

Once mathematics teachers are aware of the method and minimal training in the techniques of its application, the following uses are possible.

# (a) HOMEWORK PROGRAMS

A % home work can be set as a study of programs, which may or may not include problem solving. In this way programs can serve preparatory or self study home work. At present home work is generally used for consolidation of a class lesson.

# (b) CLASS WORK PROGRAMS

These are similar to home work programs and replace the development phase of a lesson. After class application of a program, the teacher takes over with consolidation and application work.

# (c) ENRICHMENT PROGRAM

These programs are aimed at wider horizons and deeper insight in to the course content.

There is an opportunity here for the horizontal integration of course content mathematics and the various core and elective subjects.

### (d) REMEDIAL PROGRAM

Such programs will be used to help students with particular weaknesses in the subject, to cater for dullness, backwardness and absence.

# 8. Problems in using P. I.

(a) Availability: The most serious obstacle for its use at any level of education is the supply of programs. The teachers can be encouraged to write short programs for personal use with their own classes. Home work, class work and remedial programs are suitable for an individual teacher or a group of teachers to prepare. Teacher Training colleges should offer courses in program writing to meet this need.

There is need to make P. I. materials available on a large scale, so that teachers can choose them for adoption whenever relevant.

- **(b) Form of Presentation:** The programmed text book is cheaper than presentation through a teaching machine. However simple linear teaching machines can be locally made at low cost. Greater control of students responses is possible, if such machines are available.
- (c) Administration: curriculum planning becomes more difficult, when compared to that required for the traditional system. There may be problems as a result of the changed roles of the teacher and the student. It may be difficult to duplicate the materials so that sufficient copies of the program response sheets tests etc. Are made available to the whole class.

# CONCLUSION

Mathematics Educators with a positive approach to teaching method will definitely welcome a method which offers an adaptive system presenting to students course materials having a tested reliability of mastery. There is a strong case for the use of P. I. as a teaching method, integrated in to a predominantly "class Teaching" learning environment for promoting instructional improvement.

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